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ABSTRACT

This training manual concerns the safe use of herbicides in rights-of-way. Included are sections on the impact of herbicides on non-target organisms such as in aquatic areas, on desirable vegetation, and on people and livestock. Descriptions are given of some common annual, biennial, and perennial weeds. The nature and application of herbicides are discussed and the use of herbicides for the following specific situations are given: vegetation abatement; bare ground; selective removal of undesirable vegetation; brush, woody vine, and tree control; and ornamentals. Finally, suggestions are presented for accidental spillage situations or application at excessive rates. (BB)

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RIGHT-OF-WAY PEST CONTROL

This manual was developed in cooperation with The Georgia Department of Agriculture

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RIGHT-OF-WAY PEST CONTROL

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I. INTRODUCTION

This training manual is intended to provide information to meet minimum EPA standards for certification of commercial applicators in Category 6 - "Right-of-Way Pest Control". The manual emphasis is on principles of safe use of herbicides and protection of man and the environment. This manual does not provide all the information required concerning use of herbicides in rights-of-way. More detailed information concerning this topic is available from the manufacturers of products registered for use on rights-of-way and from the Cooperative Extension Service.

II. IMPACT ON ADJACENT AREAS

It is essential to review the label for special environmental and safety hazards due to the wide variety of areas rights-of-way traverse. A principle concern in use of chemicals in all rights-of-way is containment of the treatment within the right-of-way. In all cases, steps must be taken to avoid or minimize the impact of treatments on areas adjacent to the right-of-way.

(A) Aquatic Areas - When treating areas adjacent to aquatic sites, use herbicides that are labeled for that purpose. Use care to avoid drift and vaporization and keep spray out of the water. Be alert to possible lateral movement or runoff from the treated area into the aquatic site.

(B) Desirable Vegetation (Gardens, Crops, Ornamentals, etc.): Do not apply herbicides to areas where roots of desirable plants may absorb the chemical. Desirable plants located off the right-of-way often have a considerable portion of their root systems located within the right-of-way..

(C) Sloping Areas - Sloping areas stripped of vegetation by use of herbicides will erode. In such areas, maintain a cover or mulch by occasionally skipping retreatment or through use of selective herbicides.

(D) Metal Surfaces - Certain herbicides are corrosive. In application of herbicides avoid spray contact with automobiles, buildings and various other metal surfaces, to avoid potential corrosion.

(E) Use Around People and Domestic Animals - The best guide is to handle all herbicides with care. Avoid splash or spray contact, and keep exposure to a minimum. Never keep herbicides in containers that are improperly labeled, nor easily accessible to children. Never dump unused herbicides where water supplies may be contaminated. Be sure to avoid direct contact of spray particles or herbicides with the applicator or persons and domestic animals in or nearby the treatment area.

(F) Use Around Livestock - Herbicides sprayed on plants are generally not toxic to livestock, but there are exceptions, (sodium arsenite for example). However, livestock may be poisoned by eating unused herbicides left in open containers or by drinking water contaminated with herbicides.

Certain unpalatable or poisonous plants treated with herbicides may become more palatable to livestock. Be certain that livestock cannot get to poisonous plants which have been sprayed with herbicides.

III. TYPES OF VEGETATION

The type and species and life cycle of vegetation present in a right-of-way area will dictate the herbicide or herbicide combination to use.

Unwanted or undesirable vegetation occurring on rights-of-way can be termed "weeds". The term weed will be used to refer to such vegetation in the following discussion of weeds according to their life cycle.

(A) Annuals - Weeds in this category develop from seed, flower, produce seed and die in one growing season. Annuals can be readily controlled with residual type herbicides applied prior to emergence, contact or foliage translocated materials applied postemergence or a combination of foliage or contact translocated materials plus a residual herbicide applied postemergence. Examples: beggarweeds, crabgrass, sandspur, foxtails,

FIGURE I.

Large crabgrass. A, Habit, B, florets, front and back views C, caryopsis. Annual weeds such as crabgrass complete their life cycle within one season.

(B) Biennials - Weeds in this category complete their life cycle over a two-year period (two growing seasons). Often, biennials develop from seed to a rosette form (low cluster of crowded leaves) in the first season. In the second season the stem elongates, flowers, produces seed, then dies. Control of biennials can be achieved with the same treatments used for control of annuals. Examples: wild carrot (Queen Anne's lace), common mullein, Carolina falsedandelion, redstem filaree.

FIGURE II.

Wild carrot. A, Habit; B, flowers; C, schizocarp; D, cross section of fruit. Biennial weeds such as wild carrot require two years to complete their life cycle.

(C) Perennials - Weeds of this category live for more than two years. They reproduce by seed and/or vegetative means. Plants of this group are often persistent and may require several applications of foliage translocated herbicides or use of high rates of root absorbed herbicides to achieve satisfactory control. Examples: briars, vines, brush, trees, bermudagrass, bahiagrass, kudzu, johnsongrass, plantains, curly dock, etc. (See Figure III, following page).

FIGURE III.

Johnsongrass. A, Habit B, spikelet, C, ligule, D, florets; E, caryopses. Perennial weeds such as johnsongrass live from year to year.

IV. NATURE OF HERBICIDES

Herbicides may be classified as:

(A) Selective: Herbicides in this group kill some plants while having little or no effect on others. The selective nature of certain herbicides permits their use to eliminate certain undesirable vegetation without serious deleterious effect on desirable plants. An excellent example of such selectivity is the use of 2,4-D to eliminate broadleaf weeds without serious injury to desirable grass species.

(B) Non-selective Herbicides : Herbicides in this group kill vegetation without regard to species. In some cases, selective herbicides act as non-selective herbicides if used at high rates. Examples of

such herbicides are: paraquat, dinoseb, bromacil, etc.

(C) Contact Herbicides: These herbicides kill or affect only the plant tissues which are covered in application. They produce plant kill within a few hours to a few days after application and generally provide little if any residual control. Contact herbicides control annual weeds well, but will only provide top-kill of established perennial vegetation. Common contact herbicides are paraquat, dinoseb, DSMA and MSMA.

(D) Translocated: Herbicides of this group are absorbed by plant foliage and/or roots and are translocated throughout the plant. They generally require several days to several weeks to produce plant kill. These herbicides are commonly used to control established perennial vegetation. Some herbicides in this group are 2,4-D, 2,4,5-T, dicamba and dalapon.

Herbicides of this group are generally quite selective (see part A of this section).

(E) Bare Ground Treatments (soil sterilants): The application of certain herbicides to soil at high rates results in complete control of all vegetation. The term "soil sterilant" is often used for such treatments, however, strictly speaking, this term is in error since little or no direct chemical effect is exerted upon soil microflora and fauna.

The speed of action and length of control obtained with these treatments is dependent upon plant species present, soil type, rainfall and rate applied.

Herbicides used for bare ground treatments can be absorbed by roots of established vegetation and translocated to above ground tissues. Kill of established perennial vegetation by such soil treatment is slow and costly. Contact or translocated herbicides should be combined with bare ground herbicides if established perennial or rank growth of annual vegetation is present at treatment time. Herbicides commonly used for bare ground treatments include bromacil and prometon.

V. APPLICATION

Proper application is an absolute requirement in obtaining satisfactory results from any herbicide treatment. All treatments must be applied uniformly at the recommended rate over the area to be treated. Foliage applied treatments (contact and translocated) must be applied with a sufficient volume of carrier (usually water) to assure adequate coverage.

(A) Drift: The term "drift" refers to the movement of herbicides through the air to areas not intended for treatment from areas of intended treatment. Drift is a problem of major concern in right-of-way maintenance. It presents a potential hazard to sensitive vegetation (crops, gardens,

ornamentals), wildlife, people, livestock and aquatic areas adjacent to rights-of-way. Drift occurs by two means:

(1) Particle drift - At the time of application, small spray droplets can be carried by air movement from the application area to other areas.

Particle drift depends on particle or droplet size. The effect of droplet size on particle drift is illustrated in the following table:

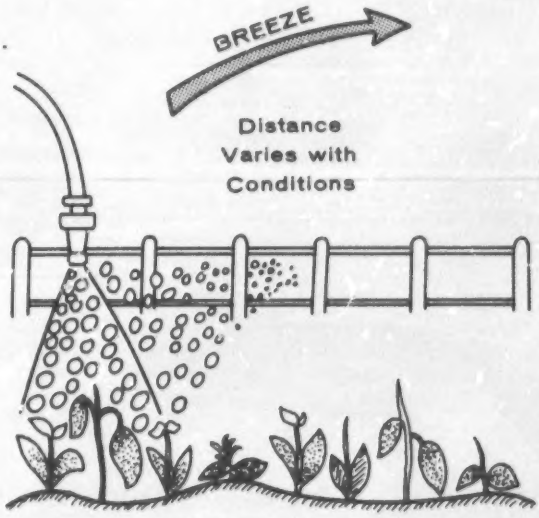

FIGURE IV.

Spray droplets may move to adjacent areas during herbicide application.

SPRAY DROPLET SIZE AND ITS EFFECT ON SPRAY DRIFT

Droplet Diameter in Microns	*Type of Droplet*	*Time Required to Fall 10 ft. in Still Air*	*Distance Droplet Will Travel in Falling 10 ft. (3 mph. Breeze)*
5	*Fog*	*66 min.*	*3 miles*
100	*Mist*	*10 sec.*	*409 feet*
500	*Light rain*	*1½ sec.*	*7 feet*
1,000	*Moderate rain*	*1.0 sec.*	*4.7 feet*

Ref. Weed Control As A Science - G. C. Klingman

Particles of fog or mist size present the greatest drift hazard. These size particles are often generated by high volume spraying equipment utilizing high pressures for foliage treatment of trees and brush.

(2) Vaporization - This results from the tendency of chemicals to vaporize or give off fumes. The movement of such fumes with wind currents may cause injury to sensitive vegetation a mile or more from the point of application.

Ester formulations of the phenoxy-type herbicides (2,4-D, 2,4,5-T, 2,4,5-TP, etc.) present the greatest potential for vaporization. Amine formulations of these herbicides are essentially non-volatile and do not present a vapor drift hazard.

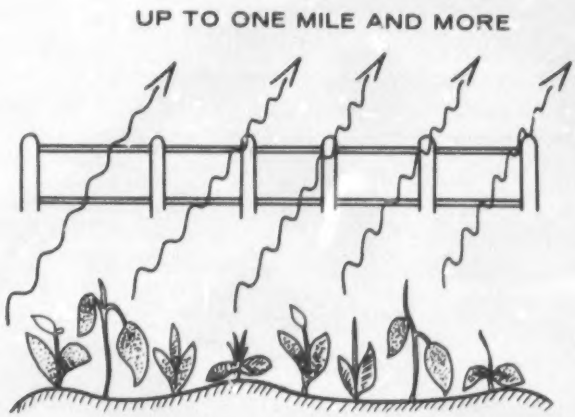

FIGURE V.

Certain herbicides vaporize after application and may cause injury to sensitive plants at a considerable distance from the place of application.

(B) Drift Control Agents[1]: Adjuvants and application systems have been developed which help overcome certain inherent drift problems that exist in conventional spraying.

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[1] This section adapted from E.I. DuPont DeNemours & Co., Inc. Manual A-86439 "Weed and Brush Control-Technical Manual for Professionals". pp. 6-7.

Three of these systems are:

(1) Foams

(2) Invert Emulsions

(3) Spray additive stabilizers

Though different in method, there are similar advantages in all three:

---Better drift control

---More highly visible spray (better placement)

A brief description of each method is:

(1) Foam-generating systems (sometimes called "Air-emulsion" systems): This system involves an adjuvant, usually used at ½-1% by volume, combined with a specially designed air expansion nozzle. The adjuvant containing solution enters the "expansion chamber" of the nozzle with a given pressure and combines with three to four parts of air to one part of water to form a "wet" foam. This results in large, viscous (heavy) spray particles.

The ½% adjuvant concentration is usually recommended for wettable powders and other formulations not containing oil. Oil containing formulations (e.g. emulsifiable concentrates) need the higher rate of 1%.

Boom spray applications with foam generating systems require a minimum of 40 psi nozzle pressure. Larger orifice nozzles such as boomless sprayers and handguns, require a minimum of 80-150 psi. Nozzle efficiency is improved with higher pressure ranges.

(2) Invert emulsions: The most common type of "emulsions" are "oil-in-water" preparations. The "inverse" of this type would be "water-in-oil" preparations. This involves preparing the herbicide in a concentrated water solution and encapsulating these particles in oil to form spray particles of a "mayonnaise" type consistency. This inversion requires a separation of the water and oil phases in separate tanks and a special mixing apparatus to combine the two phases as spraying goes on.

The specific gravity (weight) of this type preparation is the heaviest of the three concepts. Extra equipment and preparation are involved in this process.

(3) Spray additive stabilizers: There are additives which affect particle size and viscosity of spray solutions that give the same fundamental advantages as described above but require no special equipment. Spray additive stabilizers are sold under a number of different trade names.

Important mixing instructions are on the labels of these products to minimize difficulty in their use. Contact the manufacturer for specific instructions and additional information.

These materials can be used in conventional spray equipment. However, screens (strainers) smaller than 50 mesh should not be used.

All of the above-described methods should be considered as

aids under normal conditions. Under extreme conditions, such as high winds, very high temperatures, etc., caution should be exercised and labels closely observed.

(C) Lateral Movement: Caution must be exercised in use of herbicides (particularly bare ground treatments) on slopes, sandy soils and in areas that may be subject to erosion in heavy rains. All soil active herbicides can move laterally. Such movement may cause excessive destruction of vegetation and result in soil erosion or cause injury to desirable vegetation.

In areas where complete vegetation destruction may result from bare ground treatments, contact, foliage translocated or selective herbicides should be used for vegetation abatement. Vegetation abatement entails knockdown of established vegetation and/or short term residual vegetation control.

(D) Excessive Destruction of Vegetation in sloping areas resulting through herbicide use may result in erosion. Treated soils from eroded areas can cause injury to adjacent areas if carried off the right-of-way. In sloping areas, use bare ground treatments only with caution. Allow a mulch or cover to be maintained by periodically skipping retreatment. If possible, use selective herbicides to maintain a vegetation cover while removing certain objectional vegetation.

VI. USE OF HERBICIDES FOR SPECIFIC SITUATIONS

(A) Vegetation Abatement - involves the use of herbicides to provide knockdown of established plants without long term kill. These treatments are well suited for use on areas that are inaccessible to mowing equipment and where lateral herbicide movement or soil erosion may result from bare ground treatments. Some herbicides suited for this use are: dalapon (Dowpon, Basfapon), diuron (Karmex), atrazine (AAtrex), paraquat, etc.

(B) Bare Ground treatments are used where it is desirable to completely eliminate vegetation from the treated area for an extended period of time. The duration of control is dependent upon the rate applied. The higher the rate, the longer the control. These treatments are suited for use around and under sign posts, guard rails and various other obstructions in rights-of-way. Some herbicides commonly used for this purpose are bromacil (Hyvar), promaton (Pramitol), sodium chlorate, etc.

(C) Selective Removal of Undesirable Vegetation can be utilized to control undesirable grass and broadleaf weeds and brush with no deleterious effect on desirable grasses. These treatments permit maintenance of sodded areas which may be desirable for erosion control. Herbicides normally used for selective broadleaf control include 2,4-D, 2,4,5-T, 2,4,5-TP (silvex), dicamba (Banvel), etc.

Use of DSMA and MSMA will control annual and perennial

grasses except bermudagrass. Addition of a broadleaf control herbicide such as the phenoxys will control broadleaf weeds and certain woody vines such as honeysuckle. Repeat treatments will be necessary since no residual control can be expected.

(D) Brush, Woody Vine and Tree Control:

(1) Foliage treatments: After leaves have fully expanded, ammonium sulfamate (Ammate) or the phenoxy herbicides may be applied.

(2) Dormant treatments: The phenoxy herbicide 2,4,5-T may be applied with diesel fuel or fuel oil to dormant brush and woody vines. Ester formulations of the herbicide are used in such treatments and care must be taken to avoid associated vapor drift hazards (see section V).

(3) Stump and basal treatments: Sprays of 2,4-D or 2,4,5-T in diesel fuel may be applied during the dormant season to control large brush and trees. Stumps of cut trees may be treated in a similar manner to prevent resprouting. The herbicide ammonium sulfamate (Ammate) may be applied in crystalline form to frills (notches) cut in either stumps, trees or brush.

(4) Soil treatments: Certain of the bare ground herbicides such as bromacil (Hyvar) and fenuron (Dybar) may be applied as spot treatments for control of brush clumps.

(E) Ornamentals - Many rights-of-way have landscaped areas

and specimen ornamental plants which must be considered in maintenance. Precautions must be taken to prevent injury of such plants by herbicides used for routine vegetation control.

(1) Avoid drift hazards.

(2) Do not apply potentially injurious herbicides where roots of desirable plants may absorb the material.

Certain herbicides such as DCPA (Dacthal), dichlobenil (Casoron), EPTC (Eptam) may be safely used for weed control in many ornamentals. Observe all label precautions concerning the use of these products.

VII. ACCIDENTAL SPILLAGE OR APPLICATION AT EXCESSIVE RATES [2]

Most bare ground herbicides may seriously damage or kill valuable trees and should not be applied to their root systems or to areas where water from treated areas may wash into the root systems of valuable plants.

Should material be accidentally spilled or applied, then the following is suggested:

(A) <u>If Noticed Immediately</u> - Remove about 1 inch of treated soil with a shovel or flat spade and dispose of in areas

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[2] This section adapted from E.I. DuPont DeNemours & Co., (Inc.) Manual A-86439 "Weed and Brush Control-Technical Manual for Professionals". pp. 28.

where bare ground is desired. This should remove most of the herbicide. The trees should then be inspected periodically to determine whether any chlorosis develops. If in doubt as to complete removal, or as an extra-precautionary measure seven pounds of activated charcoal per 1,000 sq. ft. should be spread evenly, then incorporated lightly with a roto-tiller.

(B) If Noticed After Rain - If some time has elapsed and some rain has been received, the soil should be removed to a depth of 4-6 inches then charcoal broadcasted over the area and incorporated.

These residual herbicides are usually absorbed by clay and organic matter particles in the soil and disappear at the rate of about 80% per year. If a misapplication is noticed immediately, then most of the damage can be prevented by simply removing the upper layer of soil. However, the longer that time elapses following the application, the greater depth the chemical will penetrate into the soil and the more difficult it is to mechanically remove it with the soil. In some instances, root pruning has been effective in isolating the herbicide away from the root system, particularly when only a portion of the root system is involved.

Activated charcoal absorbs the herbicide from the soil (ties it up) and makes it unavailable to plants. By reducing the availability of the herbicide to plants, injury is minimized.

All of the preceeding suggestions are designed to be helpful, though none offers any guarantee against damage or kill to valuable trees and plants. Your best protection is to follow all label precautions and warnings in this area carefully.